ISSN: 2581-1274


# Comparative Analysis of TCP and UDP Protocol Performance in Sending Text Messages Using Chatting Applications

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ARTICLE INFO

*Article history:*
Published

*Keywords:*
TCP (Transmission Control Protocol)
UDP (User Datagram Protocol)
Text Message

ABSTRACT

TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) communication protocols are two main protocols used to send data over a computer network. Although both are often used in various network applications, they have different characteristics in terms of reliability, speed, and efficiency. This study aims to conduct a comparative analysis of the performance between TCP and UDP protocols in sending text messages using a chat application. This study was conducted by measuring several main parameters such as message delivery time, reliability level, latency, and throughput. In the TCP protocol, which is connection-oriented, the test results show that text messages are sent with a high level of reliability due to the flow control mechanism, packet sequencing, and retransmission of lost packets. However, this causes higher latency than UDP. In contrast, the UDP protocol, which is connectionless, is able to send messages with lower latency and higher throughput, but does not guarantee message reliability, because there is no retransmission mechanism for lost or damaged packets. The results of this study indicate that the choice between TCP and UDP depends on the specific needs of the application. If the main priority is message delivery reliability, TCP is superior. However, if speed and efficiency are more important, such as in real-time chat applications, UDP can be a better choice. This research is expected to help application developers in choosing the right protocol based on the performance needs of the application used.



## I. Introduction

Along with the increasing development of internet-based communication technology accompanied by the development of sophisticated smartphones, many chat applications have also been created. This application has more sophisticated features than SMS. In addition to being able to send messages in the form of text, this chat application can also send images, sound and can even be used to make calls.

When viewed from the number of messages sent, the chat application is far superior. Currently, there are 19 billion messages sent every day via chat applications, beating the number of short messages sent as much as 17.6 billion every day. The chat application itself is estimated to be able to send as many as 41 billion messages every day. This figure is also much more than twice as much as messages sent via SMS. Based on the comparative data, it is clear that currently mobile phone users prefer to send messages via chat applications rather than using SMS. This change is the first time it has occurred since the development of smartphones has become increasingly widespread every year.

In addition to its features, in terms of cost, the chat application is relatively cheaper than SMS because to be able to use the application, the device only needs an internet connection. Unlike SMS

services that require credit to be able to send messages. We cannot deny that currently we may prefer to buy internet data package credit rather than buying credit for telephone or even SMS.

In data traffic when sending messages in chat applications, a protocol is needed. A protocol is a collection of rules that regulate the communication process between electronic devices. One of the protocols on a computer network that is responsible for delivering data is the transport layer protocol. The transport layer protocol is a transport layer on the OSI layer model. This transport layer can combine several transport connections into the same connection network. There are various protocols on the transport layer including TCP, UDP and SCTP. The TCP (Transmission Control Protocol) protocol is a protocol that is 75% widely used for internet services today. However, in this protocol, when the network is dense, it automatically has an impact on very high congestion, causing time-out and will send retransmissions because of its connection-oriented nature. This will cause high delays and result in decreased throughput. While UDP (User Datagram Protocol) is a protocol intended for data delivery speed without considering congestion control and error correction in a network. However, due to the uncontrollable data transfer speed, the UDP protocol will use all the bandwidth available in the network.

From the two transport layer protocols, a comparison of reliable and fast protocol performance is needed in the process of sending text data in chat applications. The protocol performance referred to in this study is closely related to Quality of Services (QoS). Some studies on UDP and TCP include first about SCTP protocol overall is for the best QoS performance in VoIP on MPLS, UDP is superior in general network QoS and TFRC and SCTP are better in throughput [1], second about UDP protocol performance analysis using Multimedia Data Traffic [2], third about TCP and UDP traffic using Traffic routing[3], fourth about Wireless Network Performance Analysis [4], fifth about Application of Network Security System Model Based on De-Militarised Zone[5], sixth about VoIP Quality Analysis Running on Datagram Protocol[6], seventh about Bursy data traffic on the TCP protocol [7], eighth about Getting to know LAN networks[8], ninth about Wireless Network Security Analysis wireless intrusion detection [9], tenth about text messages as a combination of affine cipher algorithms with transposition ciphers and their modifications [10].

## II. Method

2.1 Data Collection Method

The data collection method used is a literature study. This method is carried out to gain a deep understanding of the research in the form of an understanding of the analysis parameters used to compare the performance of the protocol, namely the TCP and UDP transport layers. The data used in this study are incoming, outgoing, though, broadcast access speed data from each protocol and data on the use of chat applications in the form of sending and receiving text messages using the LTE network with the same data retrieval time.

2.2 Experimental Method

In this study, the author uses an experimental research method. This method is validation or testing, namely testing the effect of one or more variables on other variables.

2.2 At this stage, the author conducted a trial using data on the chat application in the form of sending and receiving text messages using the LTE network and the same trial duration. The trial process was carried out from one laptop to another that was already connected to the same LTE network and accessed Whatsapp Web via the Google Chrome browser and also had the SoftPerfect Network Protocol Analyzer software installed. The following are the hardware and software specifications used:

1. Hardware and Software
   a) Core i5 laptop
   b) 4GB memory
   c) 1TB HDD
   d) 18-inch monitor

e) Keyboard and Mouse

f) LTE wireless modem

2. Software

The software used in this study are:

a) Windows 10 operating system

b) SoftPerfect Network Protocol Analyzer

c) Whatsapp Messenger

d) Google Chrome

2.3 Thinking Framework

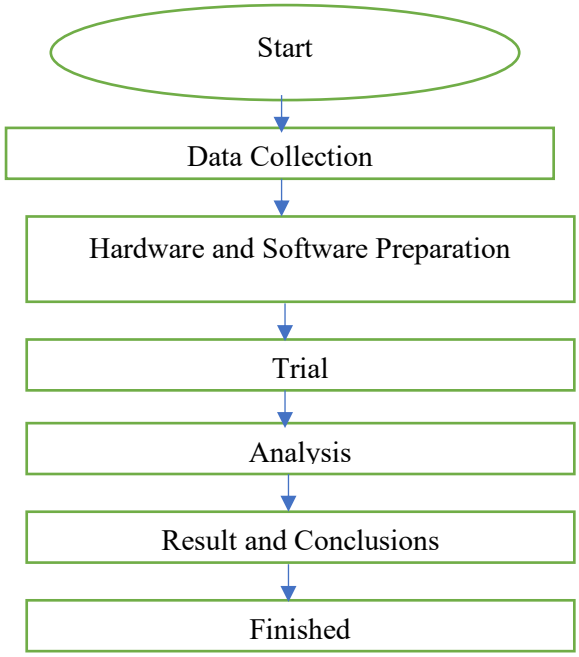


Fig 1. Research Methods

## III. Results and Discussion

The protocol used in sending and receiving text message data traffic is the TCP and UDP protocols with six parameters as a comparison of the two protocols, so that the results of which protocol is better in sending and receiving text message data traffic are obtained. The experiment was carried out 2 times with the same duration at different hours, so that it can be seen from the three times whether the final results obtained are the same or not. The following is a block diagram image used in this study.

Analysis is collecting what is needed completely to then be analyzed to define the needs that must be met. The parameters used to analyze protocol performance include:

1. Maximum flow
2. Average flow
3. Total frames transferred
4. Maximum transfer rate

5. Total data transferred
6. Average transfer rate

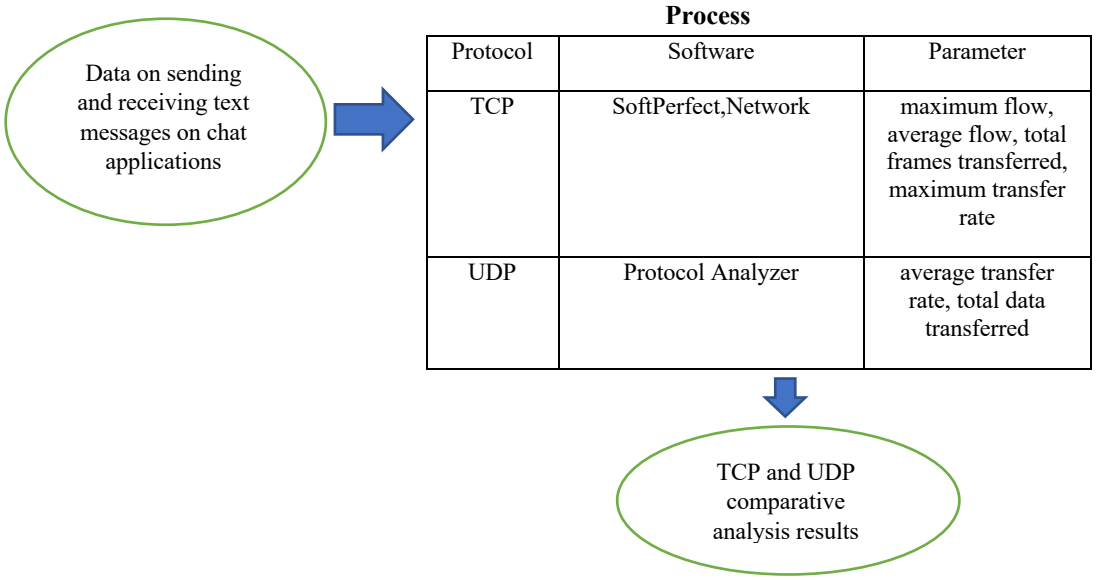


Fig 2. Research Block Diagram

Table 1. TCP and UDP protocol analysis parameters

| **Hardware Devices** | **Duration of testing** | **Testing Parameters** | **TCP and UDP Protocol** | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Incoming** | **Outgoing** | **Trough** | **Broadcast** | **Total** |
| Laptop with LTE network | 180 second | Maximum Flow | | | | | |
| | | Average Flow | | | | | |
| | | Maximum Transfer Rate | | | | | |
| | | Average Transfer Rate | | | | | |
| | | Total Data Transferred | | | | | |

The results of the performance comparison of the transport layer protocol are a comparison of the performance of the two protocols used, namely TCP and UDP, on sending and receiving text message data in chat applications and contributing to the development of protocols in these services. The text data used in the comparative analysis process of transport layer performance is WhatsApp application chat data. Data retrieval was carried out between two laptops connected to the same LTE network, both laptops accessed WhatsApp web on Google Chrome. Text messages were exchanged twice at different times with the same duration, namely 180 seconds. The experiment was conducted at 14.02 and 21.51 WIB. After the testing stage was carried out on the data used, the next step was to analyze the results of the data testing.

1. Results of text data traffic analysis on WhatsApp on the LTE network at 14.02 WIB for 180 seconds with the TCP transport layer protocol see Figure 3.
2. Results of text data traffic analysis on WhatsApp on the LTE network at 14.05 WIB for 180 seconds with the UDP transport layer protocol see Figure 4.
3. Results of text data traffic analysis on WhatsApp on the LTE network at 21.51 WIB for 180 seconds with the TCP transport layer protocol see Figure 5.
4. Results of text data traffic analysis on WhatsApp on the LTE network at 21.56 WIB for 180 seconds with the UDP transport layer protocol see Figure 6.

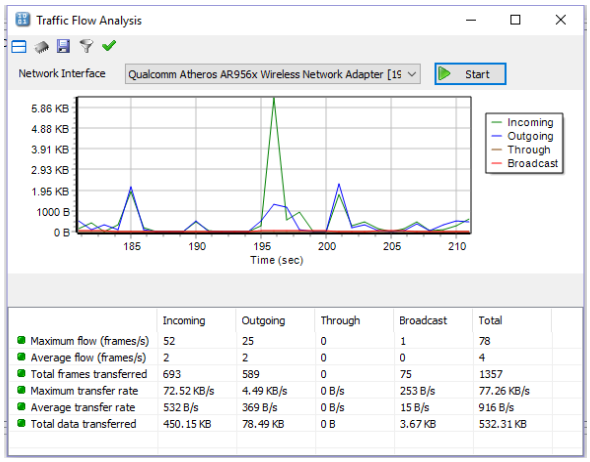


Fig 3. TCP 1 analysis results

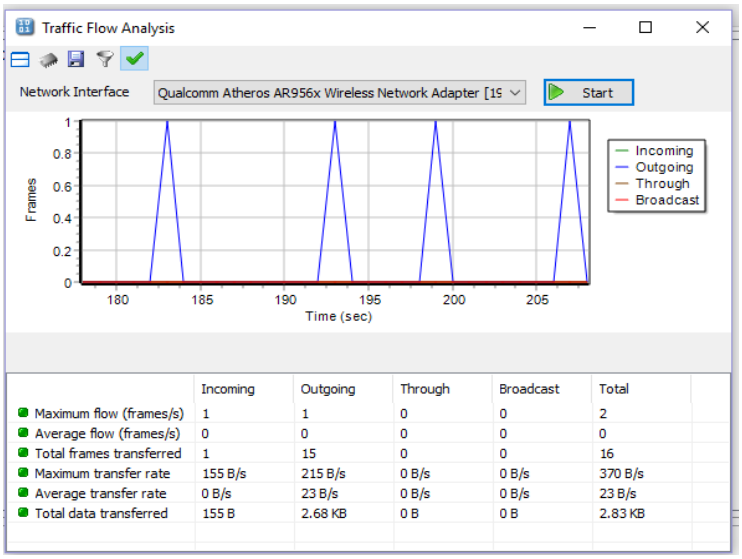


Fig 4. Results of UDP analysis 1

Table 2. Results of analysis of the first experiment

| Protocol | Incoming | Outgoing | Through | Broadcast | Total |
|---|---|---|---|---|---|
| TCP | 450.15 KB | 78.49 KB | 0 B | 3.67 KB | 532.31KB |
| UDP | 155 B | 2.68 KB | 0 B | 0 B | 2.83 KB |

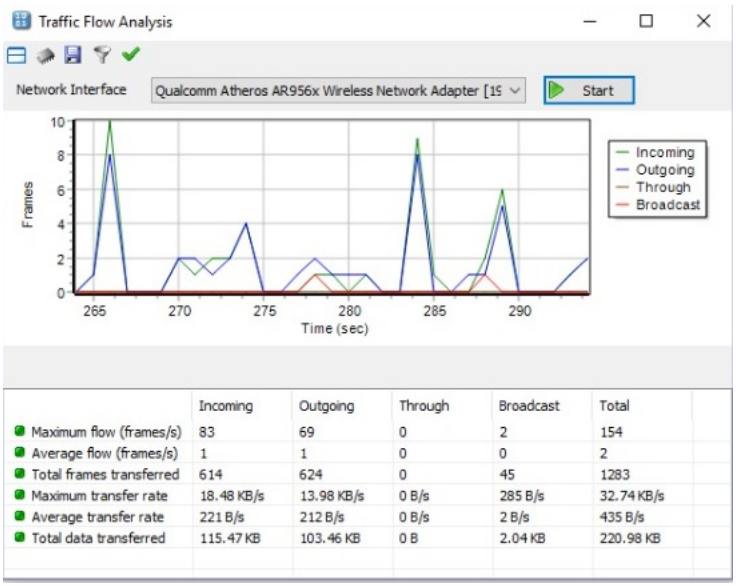


Fig 5. TCP 2 analysis results

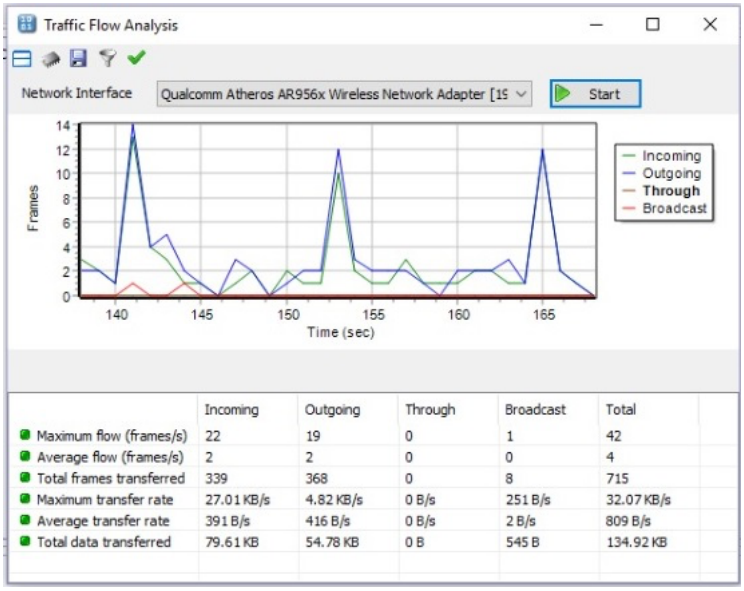


Fig 6. Results of UDP 2 analysis

Table 3. Results of analysis in the second experiment

| Protocol | Incoming | Outgoing | Through | Broadcast | Total |
|---|---|---|---|---|---|
| TCP | 115.47 KB | 103.46 KB | 0 B | 2.04 KB | 220.98 KB |
| UDP | 79.61 KB | 54.78 KB | 0 B | 545 B | 134.92 KB |

Comparison of text data on WhatsApp between TCP and UDP protocols. From the analysis results, it can be concluded that the TCP protocol is the protocol that has the best quality compared to the UDP protocol in transferring text data. This can be seen from the large amount of data that was successfully transferred (total data transferred) from the two experiments above. The TCP protocol divides the data packets sent into small parts, TCP also ensures that data is delivered to its destination.

In addition, TCP has a congestion control mechanism to regulate its transmission speed when congestion occurs. While the UDP protocol does not have congestion control.

## IV. Conclusion

Based From the performance analysis of TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) protocols in sending text messages via chat applications, several important points can be concluded as follows:

1. Data Delivery Reliability consists of TCP and UDP where TCP shows superior performance in ensuring text messages arrive without data loss due to handshake and retransmission mechanisms. This makes TCP an ideal choice for applications that require high accuracy. UDP is faster because it does not have an error control mechanism. However, it is at risk of data loss if the network is unstable.
2. Delivery Speed in UDP and TCP where UDP has lower latency than TCP because it does not require a connection process and packet acknowledgement. This makes UDP more suitable for real-time applications that are tolerant of data loss, such as voice or video calls. TCP, although slower, still provides stable performance on networks that are not too congested.
3. Influence of Network Conditions in TCP is more resistant to unstable network conditions, such as packet loss or interference, because it has an automatic correction mechanism. UDP tends to lose performance on poor networks because it does not have a recovery mechanism.
4. Suitability for Chat Applications where chat applications that focus on plain text messages (without real-time urgency) are more suitable to use TCP to ensure delivery reliability. If the chat application is used in the context of real-time communication or broadcast messages to many users (broadcast), UDP can be an alternative, provided there are additional mechanisms to overcome data loss.

By considering the advantages and disadvantages of each protocol, the choice between TCP and UDP in chat applications must be adjusted to the specific needs of the application, such as the level of reliability, speed, and network conditions.

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